

CLAIMS

WHAT IS CLAIMED IS:

- 1 1. A chemical mechanical polishing composition for polishing a metal, a
2 metal oxide, and/or a metal nitride layer of a substrate, which composition is substantially
3 free of abrasive particles and comprises:
4 a hydroxylamine derivative;
5 a corrosion inhibitor; and
6 water,
7 wherein water comprises the majority of the composition.
- 1 2. The chemical mechanical polishing composition of claim 1, wherein
2 the hydroxylamine derivative comprises hydroxylamine nitrate, hydroxylamine sulfate,
3 and/or hydroxylamine.
- 1 3. The chemical mechanical polishing composition of claim 2, wherein
2 the hydroxylamine derivative is present in a total amount from about 1% to about 5% by
3 weight of the composition.
- 1 4. The chemical mechanical polishing composition of claim 1, wherein
2 the corrosion inhibitor comprises benzotriazole.
- 1 5. The chemical mechanical polishing composition of claim 4, wherein
2 the corrosion inhibitor consists essentially of benzotriazole.
- 1 6. The chemical mechanical polishing composition of claim 5, wherein
2 the corrosion inhibitor is present in a total amount from about 0.01% to about 0.05% by
3 weight of the composition.
- 1 7. The chemical mechanical polishing composition of claim 1, wherein
2 the water is present in a total amount from about 90% to about 99% by weight of the
3 composition.
- 1 8. The chemical mechanical polishing composition of claim 1, further
2 comprising a sufficient amount of an acid and/or a base to adjust the pH of the composition to
3 a desired level.
- 1 9. The chemical mechanical polishing composition of claim 8, wherein
2 the acid and/or base are present in a total amount from about 0.01% to about 2% by weight of
3 the composition.

1 10. The chemical mechanical polishing composition of claim 1, further
2 comprising one or more of the following: a two carbon atom linkage alkanolamine
3 compound, a quaternary ammonium salt, a chelating agent, an organic solvent, a non-
4 hydroxyl-containing amine compound, a surfactant, an additional oxidizing agent, and a non-
5 abrasive additive.

1 11. The chemical mechanical polishing composition of claim 1, which is
2 substantially free of one or more of the following: hydroxylamine, acid and/or base to adjust
3 pH, two carbon atom linkage alkanolamine compounds, quaternary ammonium salts,
4 chelating agents, organic solvents, non-hydroxyl-containing amine compounds, surfactants,
5 additional oxidizing agents, and non-abrasive additives.

1 12. A chemical mechanical polishing composition for polishing a metal, a
2 metal oxide, and/or a metal nitride layer of a substrate, which composition is substantially
3 free of abrasive particles and consists essentially of:

4 about 1% to about 5% by weight of a hydroxylamine derivative selected from
5 the group consisting of hydroxylamine, hydroxylamine nitrate, hydroxylamine sulfate, and
6 mixtures thereof;

7 about 0.01% to about 0.05% by weight of benzotriazole;

8 about 90% to 99% by weight of water; and

9 less than about 2% by weight of an acid and/or a base to adjust the pH of the
10 composition to a desired level.

1 13. The chemical mechanical polishing composition of claim 12, which is
2 substantially free of hydroxylamine.

1 14. A process for chemical mechanical polishing of a substrate
2 comprising:

3 providing a substantially abrasive-free chemical mechanical polishing
4 composition that comprises a hydroxylamine derivative, a corrosion inhibitor, water, and
5 optionally a sufficient amount of an acid and/or a base to adjust the pH of the composition to
6 a desired level, wherein the majority of the composition comprises water;

7 contacting the chemical mechanical polishing composition with a substrate
8 having a metal oxide layer surface, upon which metal oxide surface a barrier layer is
9 disposed, upon which barrier layer a metal layer is disposed; and

10 chemically mechanically polishing the substrate by contacting the substrate
11 surface with an abrasive polishing pad at an applied pressure of not more than about 2 psi and
12 by moving the pad in relation to the substrate,

13 wherein the removal rate of the barrier layer greater than about 500 Å/min,
14 and wherein the removal rate of the metal oxide layer is less than about 10 Å/min.

1 15. The process of claim 14, wherein the removal rate of the metal layer
2 during the chemical mechanical polishing step is less than about 250 Å/min.

1 16. The process of claim 14, wherein the removal rate of the metal layer
2 during the chemical mechanical polishing step is greater than about 10 Å/min.

1 17. The process of claim 14, wherein the removal rate of the barrier layer
2 during the chemical mechanical polishing step is less than about 750 Å/min.

1 18. The process of claim 14, wherein the abrasive-free chemical
2 mechanical polishing composition is substantially free of one or more of the following:
3 hydroxylamine, acid and/or base to adjust pH, two carbon atom linkage alkanolamine
4 compounds, quaternary ammonium salts, chelating agents, organic solvents, non-hydroxyl-
5 containing amine compounds, surfactants, additional oxidizing agents, and non-abrasive
6 additives.

1 19. The process of claim 14, wherein the abrasive-free chemical
2 mechanical polishing composition consists essentially of:
3 about 1% to about 5% by weight of a hydroxylamine derivative selected from
4 the group consisting of hydroxylamine, hydroxylamine nitrate, hydroxylamine sulfate, and
5 mixtures thereof;
6 about 0.01% to about 0.05% by weight of benzotriazole;
7 about 90% to 99% by weight of water; and
8 less than about 2% by weight of an acid and/or a base to adjust the pH of the
9 composition to a desired level.

1 20. The process of claim 19, wherein the abrasive-free chemical
2 mechanical polishing composition is substantially free of hydroxylamine.

1 21. The process of claim 14, wherein the metal layer of the substrate
2 comprises copper.

1 22. The process of claim 21, wherein the barrier layer of the substrate
2 comprises tantalum nitride.

1 23. The process of claim 14, wherein the barrier layer of the substrate
2 comprises tantalum nitride.